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Jawline Aesthetic Definition: Enhancement with Masseteric Augmentation Using Ultrasound-Guided Fat Transfer

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Background: The rejuvenation and restoration of a well-defined jawline contour are crucial for enhancing facial aesthetics in both men and women. Within the jawline aesthetic unit (mandibular angle), the masseter muscle plays a significant role, as it is responsible for mandibular masticatory movements. We propose a new approach using ultrasound-guided intramuscular fat transfer to enhance the mandibular angle and jawline.

Methods: The multicenter study included 20 patients from three countries (Peru, Brazil, and Mexico). After fat harvesting, the ultrasound-guided masseteric fat transfer was performed with a 1.5-mm Viaro cannula from an incision beneath the ear lobule. The fat was then injected intramuscularly into the masseter at each side of the mandibular angle.

Results: Masseter ultrasound-guided fat transfer was performed on 10 men and 10 women between 2021 and 2022. The patients had a mean age of 34.4 ± 6.39 years and a mean body mass index of 22.39 ± 2.59 kg per m^2. The mean injected volume was 5.83 mL and 5.58 mL on the right and left sides, respectively. Muscle thickness increased in patients immediately postsurgery, but decreased after 1 month. The muscle remained significantly thicker on each side than the presurgery measurements in patients regardless of gender (both $P < 0.0001$).

Conclusions: Ultrasound-guided intramuscular fat transfer is a safe and reproducible technique for enhancing the jawline contour at the mandibular angle. We believe that it could be a more durable solution than other procedures, although further evaluation of long-term results is necessary. *(Plast Reconstr Surg Glob Open 2024; 12:e5695; doi: 10.1097/GOX.0000000000005695; Published online 22 March 2024.)*

INTRODUCTION

A well-defined jawline is considered a symbol of youth and beauty in both men and women.[1] It is crucial to focus on rejuvenating and harmonizing this region to achieve optimal facial aesthetics.[2] Various surgical and nonsurgical procedures are available for this purpose.[3,4] Among them, the masseter muscle holds the greatest significance, as it is the largest muscle responsible for mandibular masticatory movements and also forms an integral part of the jawline aesthetic unit.[5]

Pathological conditions such as emotional stress, chronic bruxism, nocturnal bruxism, and masseteric hyperfunction can lead to hypertrophy of the masseter muscle.[6–8] Botulinum toxin type A is a safe and effective treatment for masseter hypertrophy.[9] Conversely, atrophy and hypotrophy of the masseteric muscles are commonly observed in older individuals, often resulting in masticatory and deglutition disturbances.[10]

Fat transfer is the most appropriate approach for facial augmentation and rejuvenation, either as a standalone procedure[11,12] or in combination with other techniques.[13]

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although several methods have been described for masseteric anatomic zone fat transfer,[14,15] none of them specifically focus on enhancing the muscle volume through intramuscular fat transfer, which can offer both aesthetic and functional benefits.

Currently, most procedures targeting the mandibular angle lack precision and fail to provide sustainable results over time. In certain cases, for the treatment of muscle hypertrophy, ultrasound-guided injection of botulinum toxin is administered into the masseter muscles.[16–18] To address these challenges, we present a new technique for masseteric enhancement called masseteric ultrasound-guided fat transfer (MASSFAT). Moreover, the technique seeks to augment the jawline contour safely by utilizing ultrasound guidance for precise intramuscular fat transfer and exploiting autologous tissue for better long-term results.

Takeaways

Question: Does the MASSFAT procedure effectively increase the thickness of the masseter muscle?

Findings: The MASSFAT procedure significantly increases the thickness of the masseter muscles, and the results observed remain 1 month after grafting ($P < 0.0001$).

Meaning: The MASSFAT technique is a safe and reproducible masseter volumization procedure, and no adverse events were recorded during this study.

PATIENTS AND METHODOLOGY

The multicenter study was conducted across three countries, namely Peru, Brazil, and Mexico. A total of 20 patients (10 men and 10 women) who sought to enhance their mandibular contour were recruited from outpatient clinics. All patients underwent evaluations conducted by three board-certified plastic surgeons who were trained in this specific procedure. Upon receiving a detailed explanation of the new approach, the patients voluntarily opted to undergo the procedure and provided a signed informed consent form before participating. This study complied with the provisions of the Declaration of Helsinki.

All of the patients included in the study met the following criteria: (1) individuals with poorly defined jawlines who desired a method to enhance this feature; (2) age between 18 and 45 years; (3) a body mass index of less than or equal to 28 kg per m^2; and (4) a surgical risk score of 2 or less, based on the Goldman Index. Patients with neck flaccidity, a history of head and neck surgery, or temporomandibular joint dysfunction (whether in plastic surgery or other medical specialties) were excluded. Furthermore, the patients' goals and objectives were also considered (Table 1).

The patients underwent body contouring surgery along with masseteric volumization through ultrasound-guided fat transfer, performed by three plastic surgeons trained in soft tissue ultrasound. For this purpose, a calibrated and standardized ultrasound device, specifically the Clarius L7 HD, was used.

Surgical Planning

Preoperative photographs were obtained for each patient as part of the procedure. The markings were designed in a sitting position with the patient facing forward. Additionally, the patient was instructed to perform a forced mandibular occlusion so that anterior and posterior borders of the masseter muscle on both sides could be identified. Marking was also performed for the mandibular body and angle. Subsequently, an ultrasound scan was performed in the same position using a linear array transducer to confirm the anatomy and boundaries of the masseter, as well as the location of the parotid gland. It also assisted in localizing the graft site, specifically the inferolateral portion of the masseter muscle corresponding to the mandibular angle (Fig. 1).

Table 1. Descriptive Statistics

	Patients	Age (Mean in Years)	Body Mass Index (kg/m^2)
Men	10	33.9 ± 5.1	22.68 ± 2.67
Women	10	34.9 ± 7.72	22.09 ± 2.61
Total	20	34.4 ± 6.39	22.39 ± 2.59

Surgical Technique

Fat Harvest

All of the patients received general anesthesia for the procedure. The fat was collected from the periumbilical region. Before the fat collection, subcutaneous infiltration was performed using a solution of normal saline and epinephrine at a ratio of 1:1.000.000, following the super-wet technique. After 15 minutes, deep suction-assisted liposuction was initiated using a blunt 4-mm Mercedes cannula. The suction pressure was limited to 160 mm Hg. The aspirated fat was collected in a closed system, processed through decantation for 15 minutes, and then transferred to 20-mL Luer-lock syringes, which were then transferred further to 10-mL Luer-lock syringes for injection.

Masseter Augmentation with Fat Transfer

A 5-mm incision was made in the inferior region of the auricular lobe, specifically in the space between the mastoid process and the mandible, at the level of the mandibular angle. Throughout the procedure, ultrasound guidance was consistently used while considering the facial danger zones. Ultrasound guidance also assists in the identification and isolation of the masseter and parotid fascia and nearby vascular vessels. A 1.5-mm Viaro cannula, aligned parallel to the linear transductor and the edge of the mandibular body, was inserted into the designated region. The parotid fascia was retracted, and the superficial face of the masseter fascia was perforated (signified by a "pop" sensation) in the direction of the mandibular angle. By positioning the linear transductor perpendicular to the cannula and using a wobble movement, the intramuscular position was confirmed. The tip of the cannula was positioned over the inferolateral aspect of the muscle at the mandibular angle, and an intramuscular fat bolus was administered until the desired contour was achieved (Fig. 2). Muscle expansion was confirmed under ultrasound guidance during the fat transfer. The same procedure was replicated on the contralateral side.

Fig. 1. Preoperative design of the MASSFAT technique (markings): mandibular contour (ramus, angle, and body; blue line); masseter muscle at mandibular angle (red square); masseter muscle volumization region (red cross).

Incisions were closed using 5.0 nylon sutures. Upon completion of the procedure, a compressive drape made of micropore fabric was applied and left in place for 4 days. [See **Video 1 (online),** which displays the MASSFAT technique, we can see the muscle fascia (F), the masseter muscle (M), the inferior maxilar (B), and the intramuscular fatgraft in masseter muscle (FG).]

Ultrasonographic Measurements

Before the procedure, ultrasound is performed in the masseteric region, locating the proximal one-third and the medial one-third of the masseter muscle. Close to the puncture site, the intersection of both thirds is marked, and measurements are made. The same procedure is repeated in the postoperative period, locating the previously marked point to measure muscle thickness, using ultrasonographic guidance.

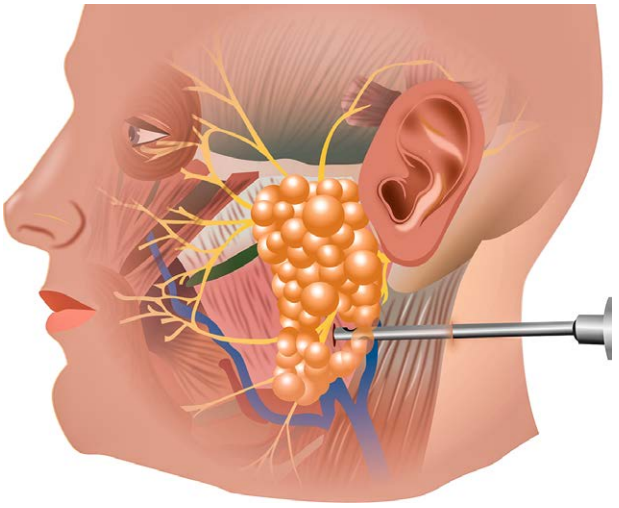

Fig. 2. MASSFAT procedure and anatomical references: parotid gland (orange), fascial nerve (yellow), Stensen duct (green), jugular vein (blue).

Statistical Analysis

Statistical analysis was performed using STATA/IC 15.0 software (StataCorp, College Station, Tex.). Descriptive statistics were used to summarize the quantitative variables, which were presented as means and SDs due to the symmetrical distribution of the data. Categorical variables were presented as absolute frequencies and percentages. The mean masseter muscle thickness with its 95% confidence interval was compared using Student *t* test for paired samples. The statistical significance value was set at a *P* value less than 0.05.

RESULTS

The MASSFAT technique for enhancing the jawline was performed on a total of 20 patients between January 2021 and November 2022. Of these patients, 10 were women and 10 were men, with a mean age of 34.4 years (range, 23–42). The description of the study population is shown in Table 1. The mean volume of the fat transferred to masseter muscles was 5.83 mL and 5.58 mL on the right and left sides, respectively. Muscle thickness was measured on each side before the fat transfer, immediately after the fat transfer, and 1 month postsurgery (Table 2). However, two patients failed to provide the required measurements 1 month postsurgery. In general, men had thicker muscle on the right side, except for the measurement at 1 month postsurgery. The right masseter was thicker than the left masseter in all measurements, except for those obtained 1 month after surgery. This discrepancy may be attributed to higher fat reabsorption in men on the right side.

In all patients, muscle thickness increased after the fat transfer. However, 1 month postsurgery, it decreased below the measurement limit immediately following the fat graft. This change was significant in both cases. Nevertheless, the measurement obtained 1 month postsurgery remained higher than presurgery, and this difference was statistically significant in all patients even when analyzed separately for men and women ($P < 0.0001$; Fig. 3).

Table 2. Measurement of Masseter Muscle Thickness before and after Fat Transfer

	Before Surgery		After Surgery		1 Month after Surgery	
	Right (cm)	Left (cm)	Right (cm)	Left (cm)	Right (cm)	Left (cm)
Men	1.01±0.15	0.88±0.23	2.16±0.26	1.97±0.27	1.83±0.29	1.82±0.49
Women	0.95±0.13	0.88±0.1	1.98±0.16	1.84±0.17	1.63±0.26	1.54±0.46
Total	0.98±0.14	0.88±0.17	2.07±0.23	1.91±0.23	1.73±0.29	1.68±0.48

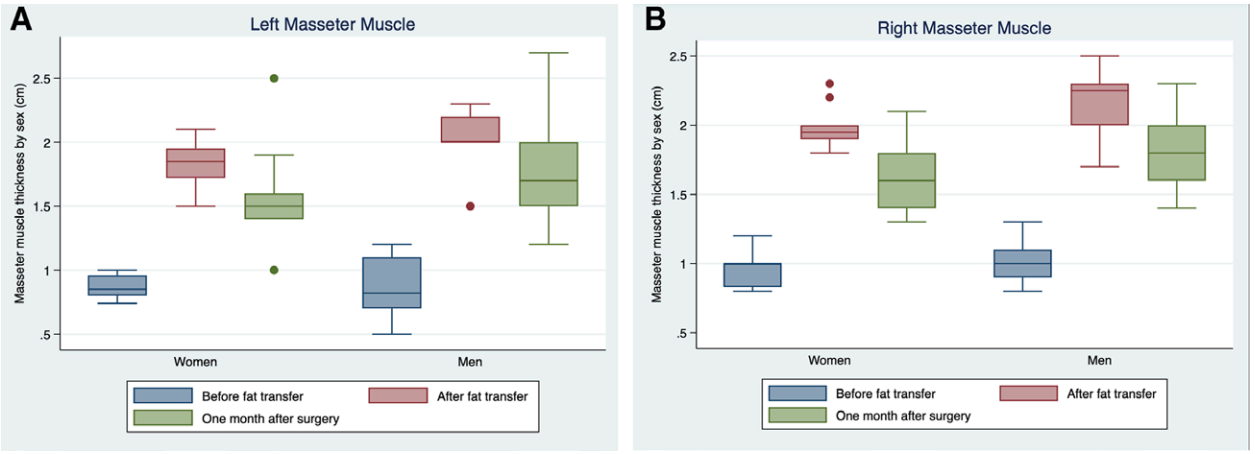

Fig. 3. A, Left masseter thickness over time by gender. B, Right masseter thickness over time by gender.

DISCUSSION

A well-defined jawline is considered a hallmark of a beautiful and youthful lower face in both men and women. As individuals age, there is a natural decline in facial volume due to a decrease in fat within facial compartments and a reduction in elastic skin fibers. Furthermore, hypotrophy and atrophy can affect facial muscles, including masseter muscle, which has functional and aesthetic consequences.[10]

Different techniques have been described to address a weak or poorly defined jawline, but to our knowledge, none of them have used our approach, which directly enhances masseter muscle volume. This particular location is critical to address as vital structures pass through it, and improper technique can result in serious injuries to the passing structures. Some of the structures passing through are facial vessels, facial nerve, parotid gland, and Stensen duct. As we have outlined in the article, a better and safer approach is to use ultrasound guidance.

Moreover, the use of ultrasound guidance is one of the most important aspects of this technique, given the complexity of the anatomy in this region. It is imperative and necessary to have a detailed understanding of the anatomy of this particular region, as injury to certain structures can have deleterious consequences. Motor branches of the facial nerve, sensory branches of the trigeminal nerve, and the cervical plexus are at risk of being injured. Therefore, familiarity with the facial danger zones can be helpful. Additionally, recognizing the vascular anatomy, particularly the collateral and terminal branches of the external carotid artery, is also crucial. The parotid gland and Stensen duct are also relevant structures to consider. The parotid fascia lies superficial to the masseter muscular fascia; so it is important to identify both to ensure the correct entry point. By carefully dissecting the parotid fascia on its posterior aspect, direct access to the masseter fascia at the level of the mandibular angle can be achieved. Ultrasound facilitates the identification and avoidance of vital structures, thereby enabling the masseter fat transfer to be accomplished more safely[17] (Figs. 4 and 5).

As demonstrated in our study, we believe that this technique has a short learning curve and consistently yields reproducible results. Although there was some observed loss of volume in the first control group at 1-month postsurgery, the remaining volume was still significantly higher than the presurgery volume, as confirmed both clinically and sonographically. However, it is important to continue monitoring and evaluating the long-term outcomes of this procedure, as one of the possible advantages is the long-term permanence of the fat graft compared with other fillers. It is worth mentioning that there were no complications in the study; hence, we believe it is a safe procedure. **[See figure, Supplemental Digital Content 1,** which displays (A) preoperative, (B) immediate postoperative, and (C) 1-month postoperative MASSFAT technique without muscle contraction in a woman. **http://links.lww.com/PRSGO/D119.] [See figure, Supplemental Digital Content 2,** which displays (A) pre-operative and (B) 1-month postoperative MASSFAT technique without muscle contraction in a woman. **http://links.lww.com/PRSGO/D120.]**

The limitations of this study include the small number of patients and the relatively short follow-up period. However, other studies have demonstrated long-term fat grafting retention in the face and other anatomical locations.[19–21] **[See figure, Supplemental Digital Content 3,** which displays frontal (A) and lateral (C) views of preoperative and frontal (B) and lateral (D) views, 1-year postoperative MASSFAT technique without muscle

Fig. 4. Immediate preoperative (A) and postoperative MASSFAT technique (B) without muscle contraction in a woman.

Fig. 5. Immediate preoperative (A) and postoperative MASSFAT technique (B) without muscle contractions in a man.

contraction in a woman. **http://links.lww.com/PRSGO/D121**.] **[See figure, Supplemental Digital Content 4,** which displays frontal (A) and lateral (C) views of preoperative and frontal (B) and lateral (D) views, 1 year postoperative MASSFAT technique without muscle contraction in a man. **http://links.lww.com/PRSGO/D122**.]

CONCLUSIONS

Based on our experience, we consider ultrasound-guided fat grafting of the masseter muscle to be safe, reproducible, and characterized by a short learning curve. Fat transfer could be a way to enhance the jawline contour along with tissue quality and function more permanently, especially at the mandibular angle. We must still evaluate long-term follow-up and accumulate more information to obtain more definitive conclusions that may encourage new lines of research.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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